# The central SPURS mooring and UCTD sampling

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Doctored photo of Red Sea buoy

SPURS buoy

# Buoy/mooring measurements:

(1) Measurements of surface meteorology and radiation with dual IMET packages; surface waves; precip enhancements

(2) Direct turbulent flux measurements (wind stress, latent heat flux/evap, sensible heat flux)

(3) Measurements of T, S, and U with good vertical and temporal resolution (<5m in upper 90 m)



PO Mooring # 1250

BUOY WATCH CIRCLE ~ 4 N.Miles

2.7 m Surlyn Buoy with (2) IMET/Iridium Telemetry, XEOS GPS, SA AT/H, LASCAR VIASALA WXT 520,HASSE PRECIP. LICOR, DCFS, WAMDAS

Bridle with (2) IMET Temp. Sensors at 0.75 m Depth, and Backup XEOS Transmitter

0.2m - 4 TR 1060 Fixed In Hull

DEPTH

*SPURS MOORING*
*V13- Sheet 1 of 2*
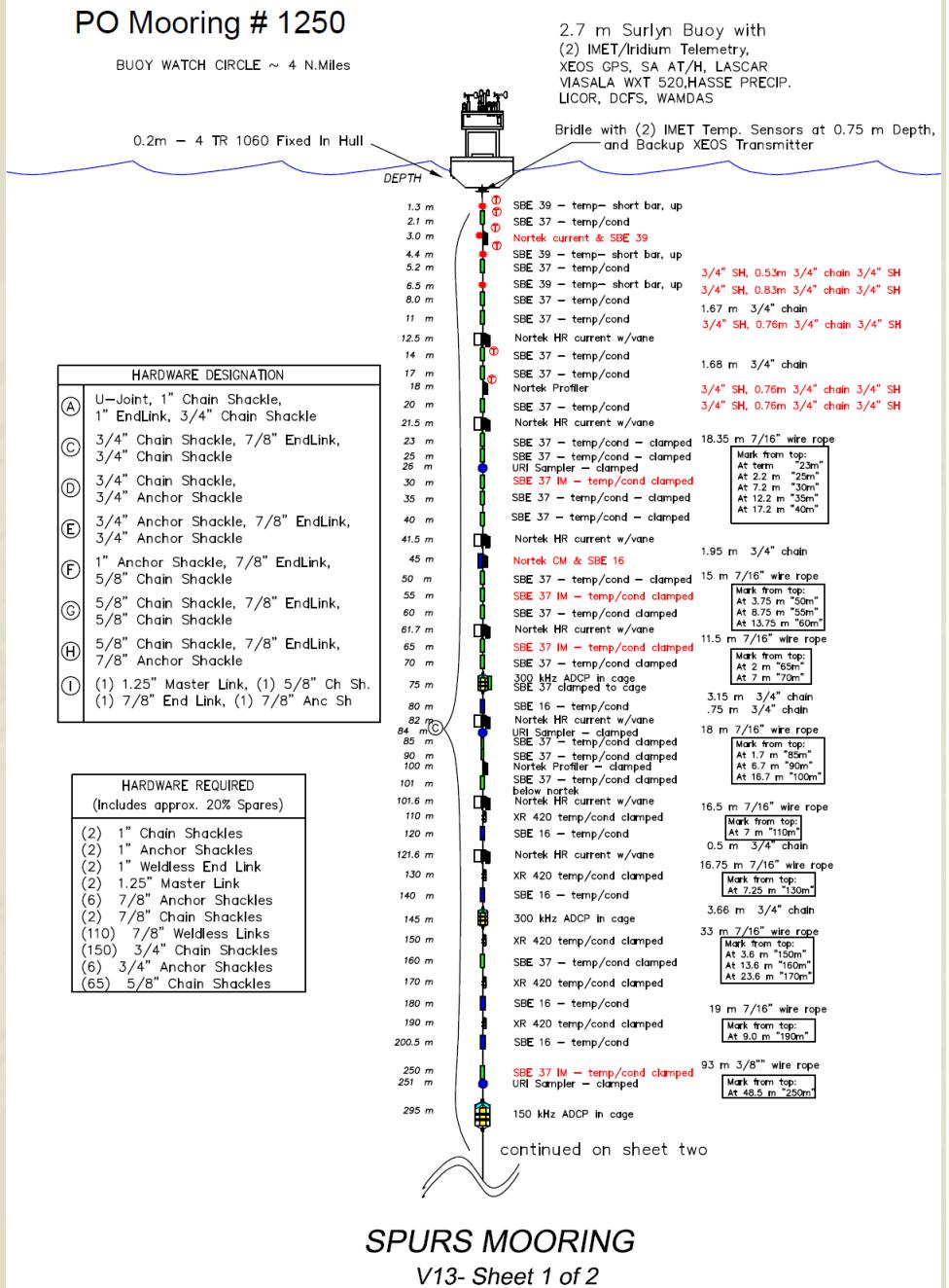
## Some of the buoy measurements:
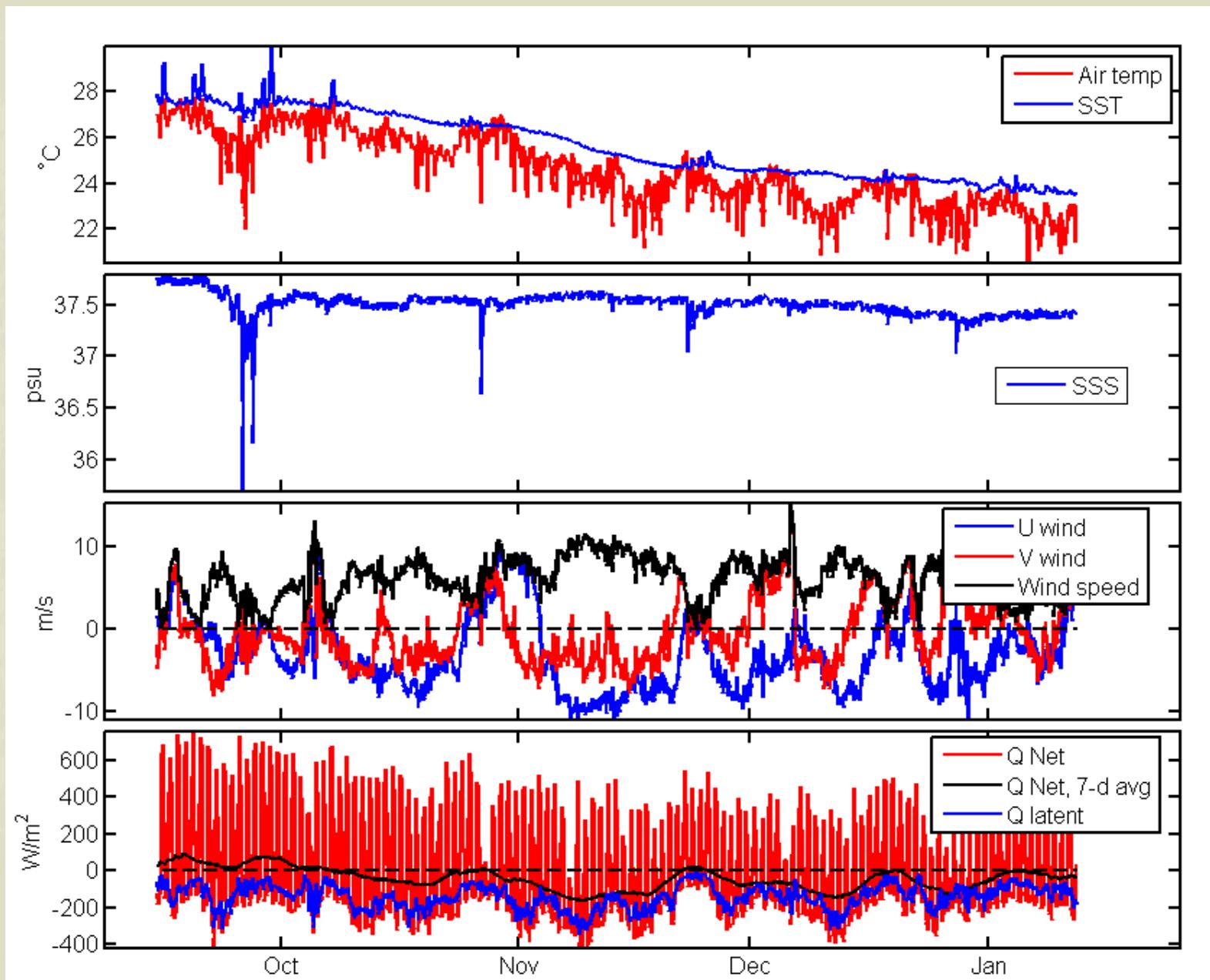
→Vertically averaged budget equations: $\quad \overline{S} = \dfrac{1}{h}\displaystyle\int_{-h}^{0} S\,dz \quad S(z) = \overline{S} + \hat{S}(z)$

$$\frac{\partial \overline{S}}{\partial t} = -\overline{\mathbf{u}} \cdot \nabla \overline{S} + \hat{S}_{-h}\left( \frac{\partial h}{\partial t} + w_{-h} + \vec{u}_{-h} \cdot \nabla h \right) - \frac{Q_{-h}}{\rho h} + \frac{(E-P)S_o}{\rho h} - \frac{1}{h}\nabla \cdot \int_{-h}^{0} \hat{\vec{u}}\hat{S}\,dz$$

$$\frac{\partial \overline{T}}{\partial t} = -\overline{\mathbf{u}} \cdot \nabla \overline{T} + \hat{T}_{-h}\left( \frac{\partial h}{\partial t} + w_{-h} + \mathbf{u}_{-h} \cdot \nabla h \right) - \frac{Q_{-h}}{\rho c_p h} + \frac{Q_o}{\rho c_p h} - \frac{1}{h}\nabla \cdot \int_{-h}^{0} \hat{\vec{u}}\hat{T}\,dz$$

# Argo float positions/surface temp over ~Sept/Oct:
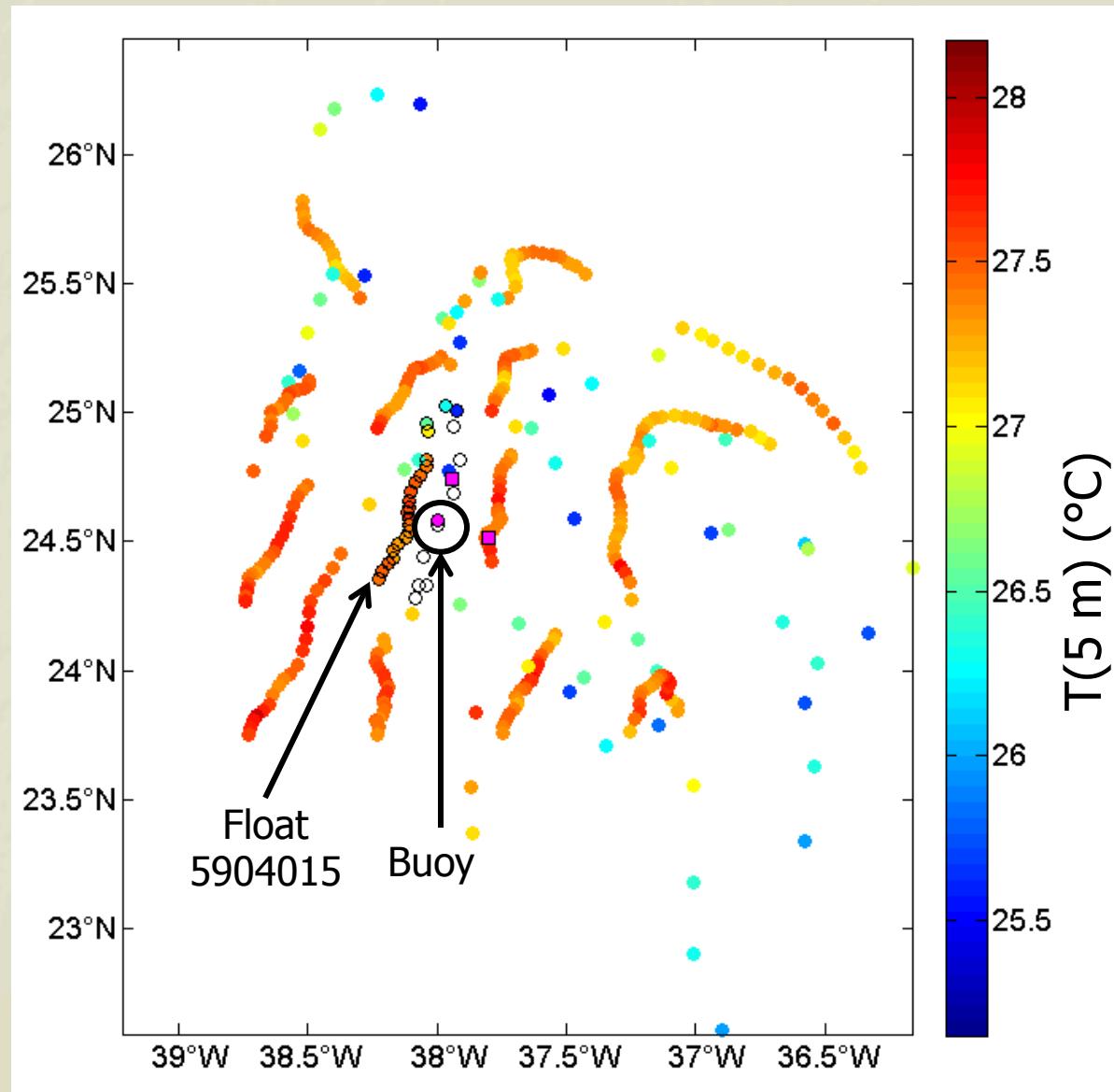
Salinity, float 5904015

Temperature, float 5904015

$\Delta \sigma_o = 0.2 \text{ kg/m}^3$
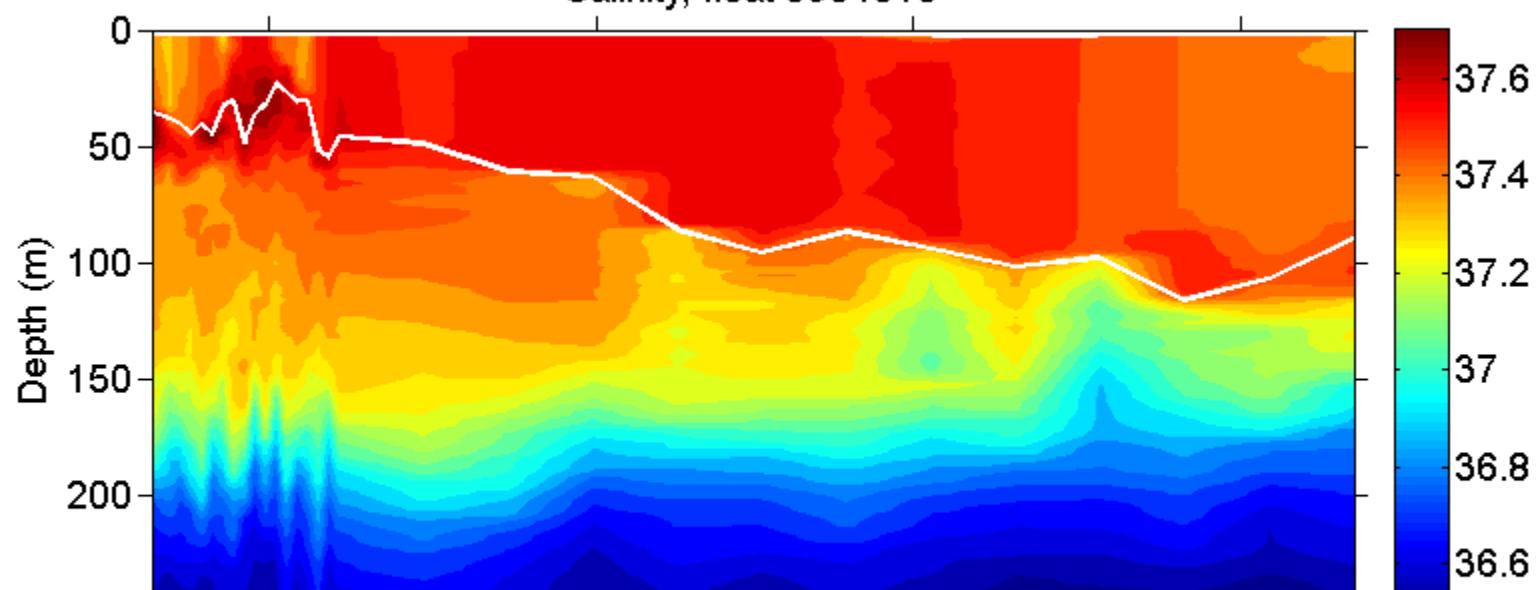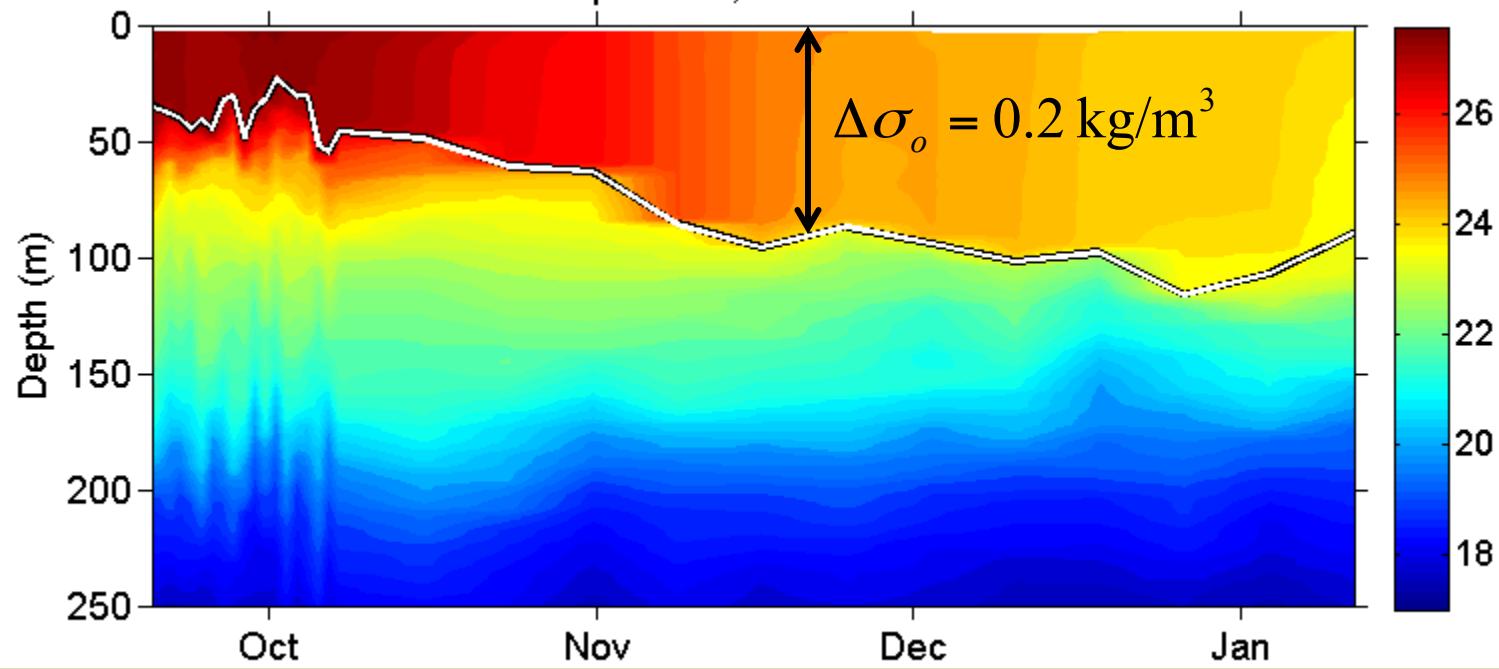
# Preliminary mixed-layer temperature balance:

Evaluated for 3-week running average:

Argo float

Argo float

$$\rho c_p \kappa \frac{\partial T}{\partial z} \quad \text{buoy}$$

$$\frac{\partial \overline{T}}{\partial t} = -\overline{\mathbf{u}} \cdot \nabla \overline{T} + \hat{T}_{-h}\left(\frac{\partial h}{\partial t} + w_{-h} + \mathbf{u}_{-h} \cdot \nabla h\right) - \frac{Q_{-h}}{\rho c_p h} + \frac{Q_o}{\rho c_p h} - \frac{1}{h}\nabla \cdot \int_{-h}^{0} \hat{\vec{u}} \hat{T} dz$$



Temperature, float 5904015

$$\Delta \sigma_o = 0.2 \, \text{kg/m}^3$$
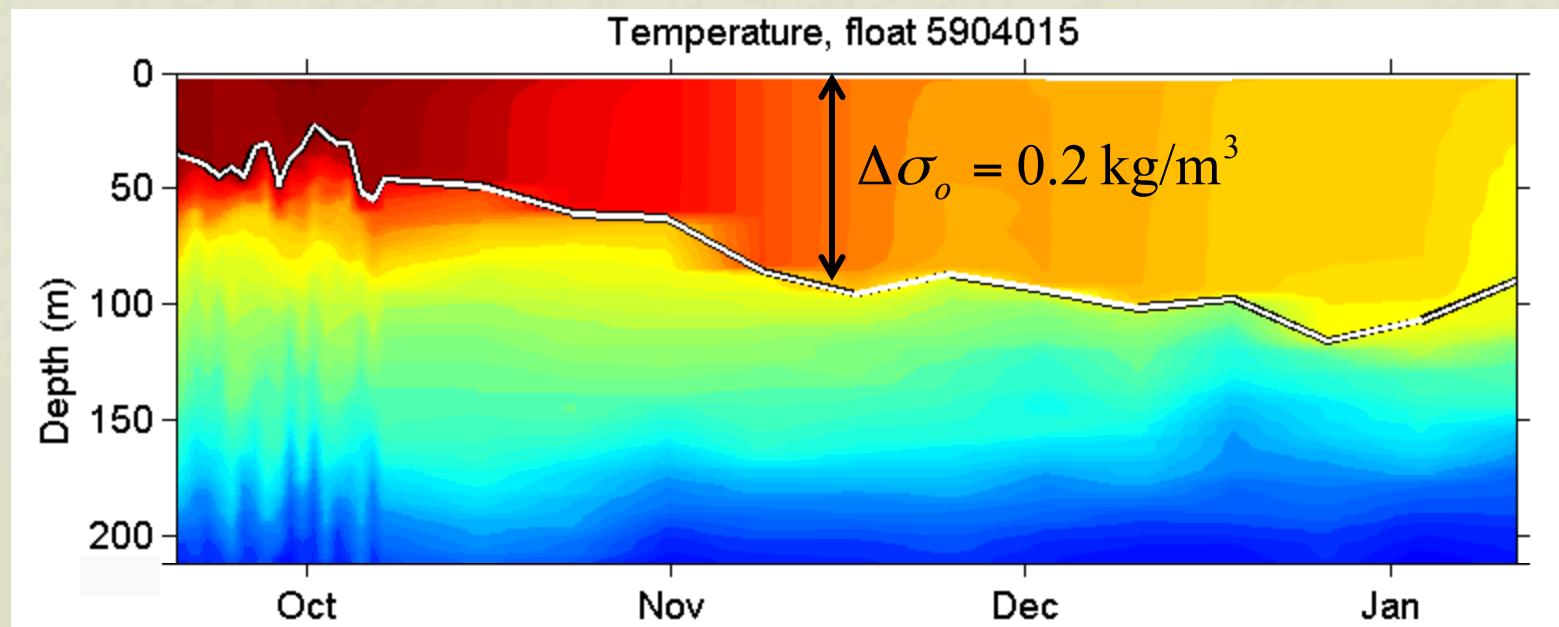
Preliminary mixed-layer temperature balance:
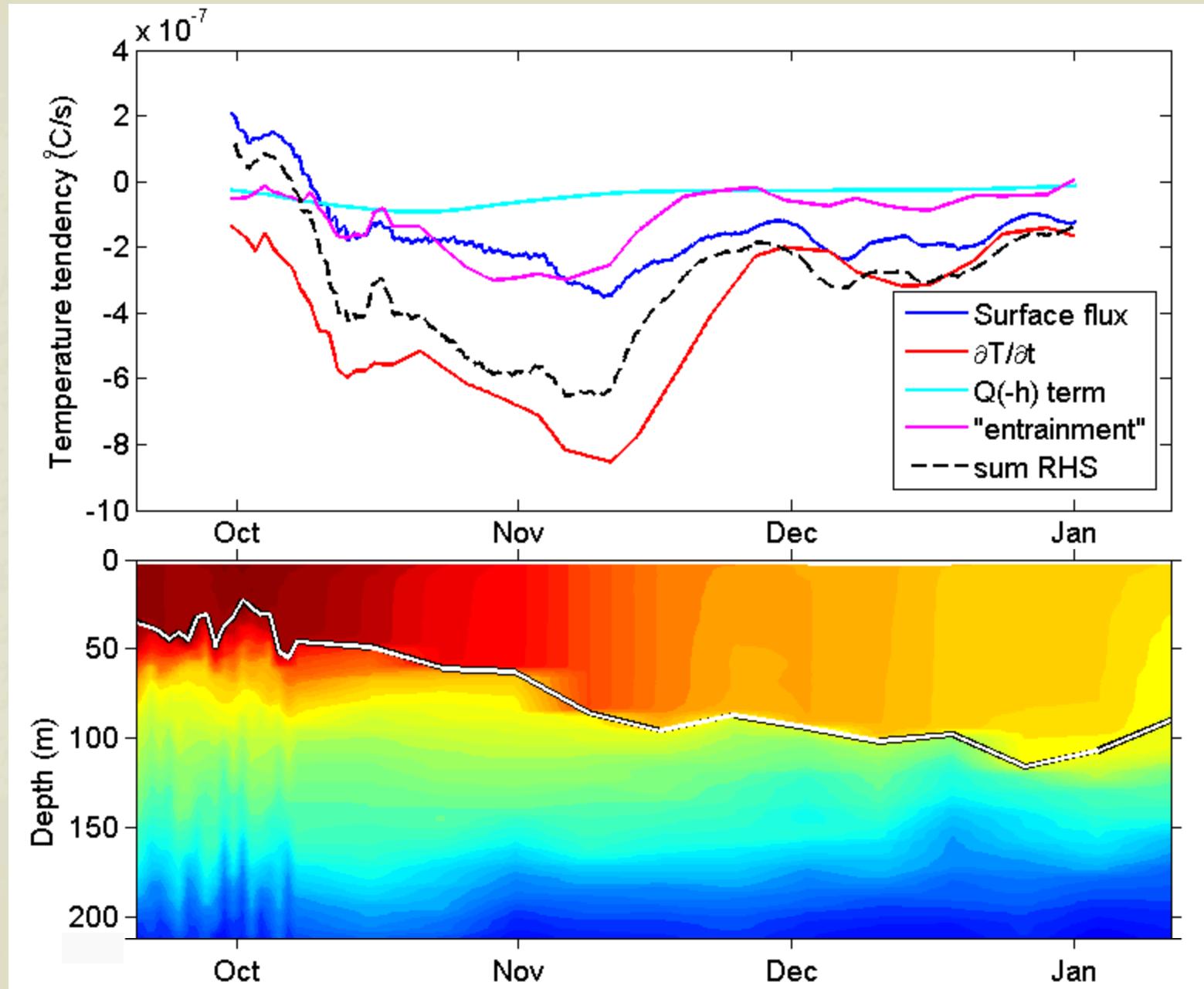
Preliminary mixed-layer salinity balance:
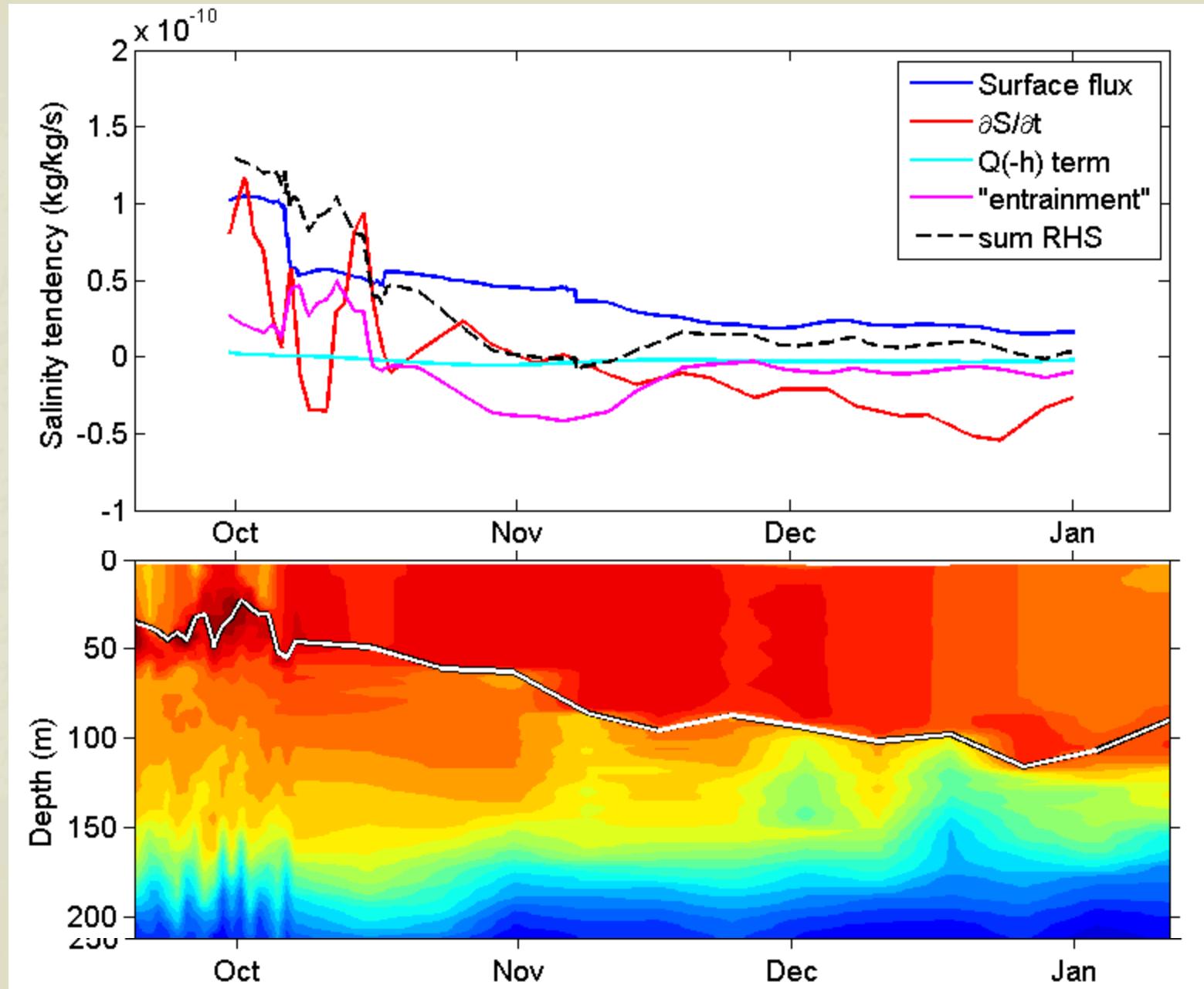
Inferences from this preliminary budget:

(1) The mixed-layer temperature tendency is roughly balanced by the sum of surface heat flux and mixed-layer "entrainment" terms

(2) The mixed-layer salinity balance appears to be far from 1D

(3) This difference is not too surprising because horizontal gradients of SSS are relatively strong.  This can be rationalized by noting that surface heat fluxes will tend to damp SST anomalies, while surface freshwater fluxes are essentially independent of SSS.

   (There is in fact a weak tendency for evaporation to *amplify* SSS anomalies because the virtual salt flux is ~E×SSS.)

## Underway CTD sampling on 2012 cruise (400 m casts):



UCTD sampling, 16−Sep−2012 to 05−Oct−2012
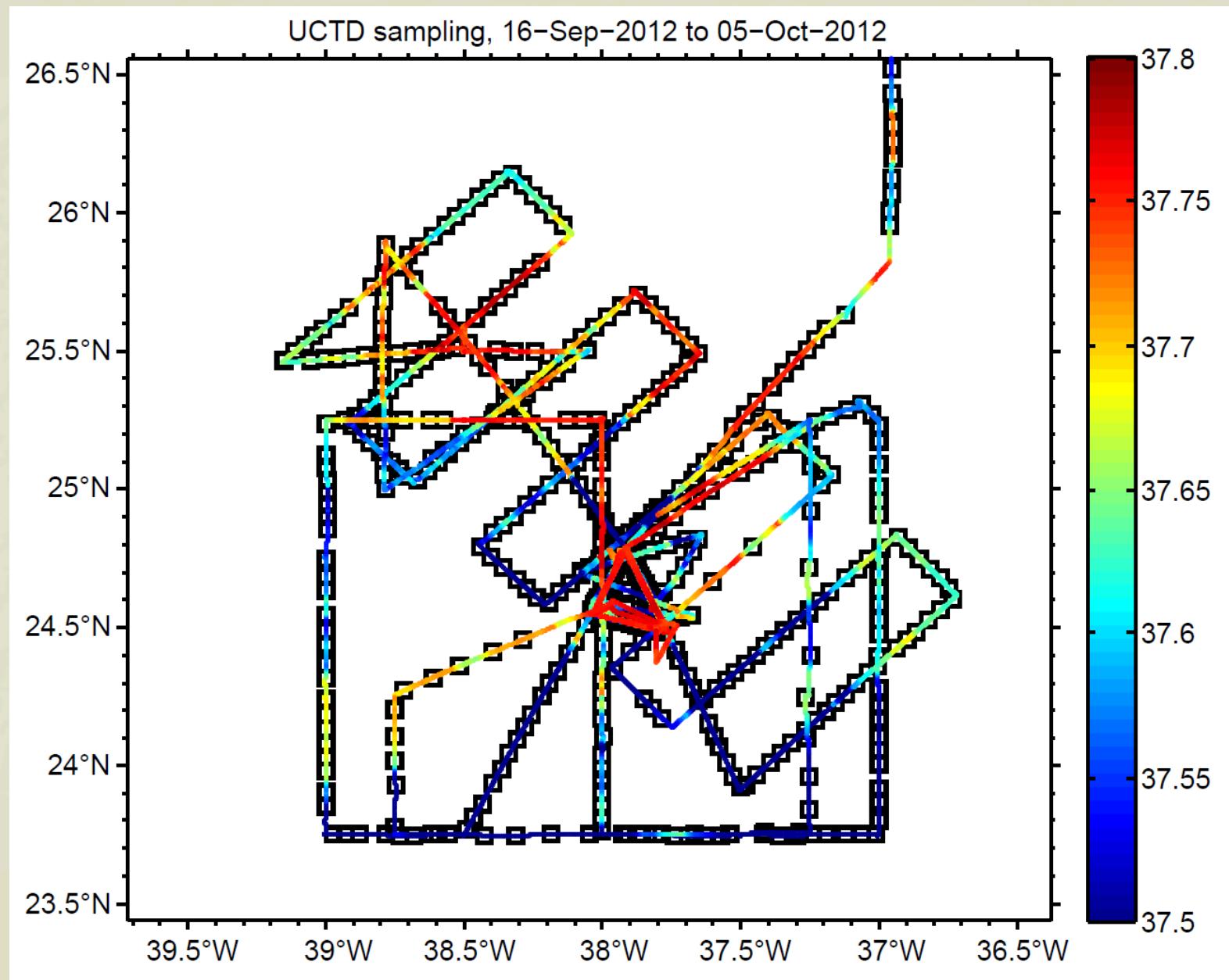
# UCTD vs. shipboard CTD and TSG
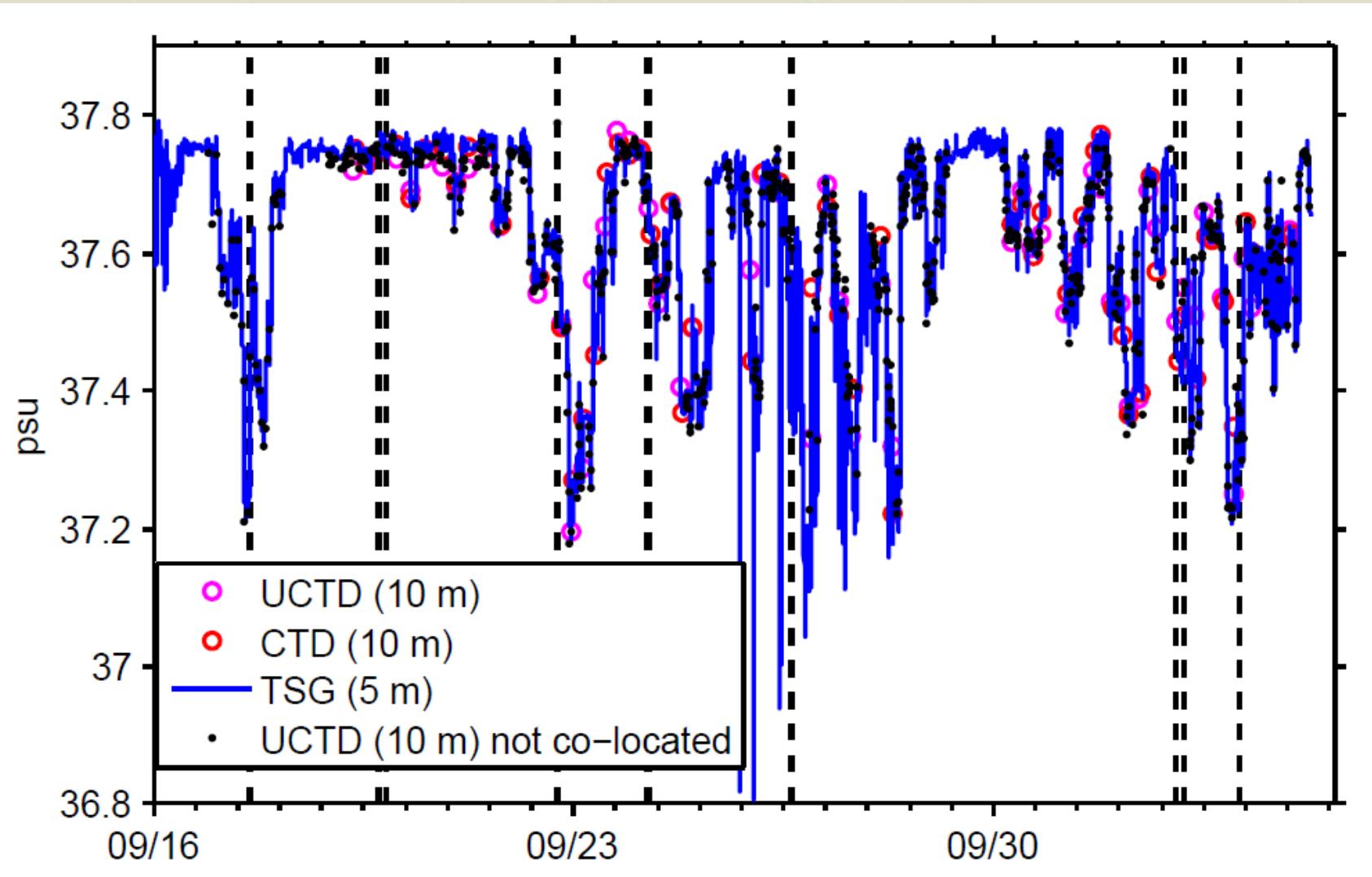
# A more stringent test: UCTD vs. shipboard CTD on 16°C isotherm
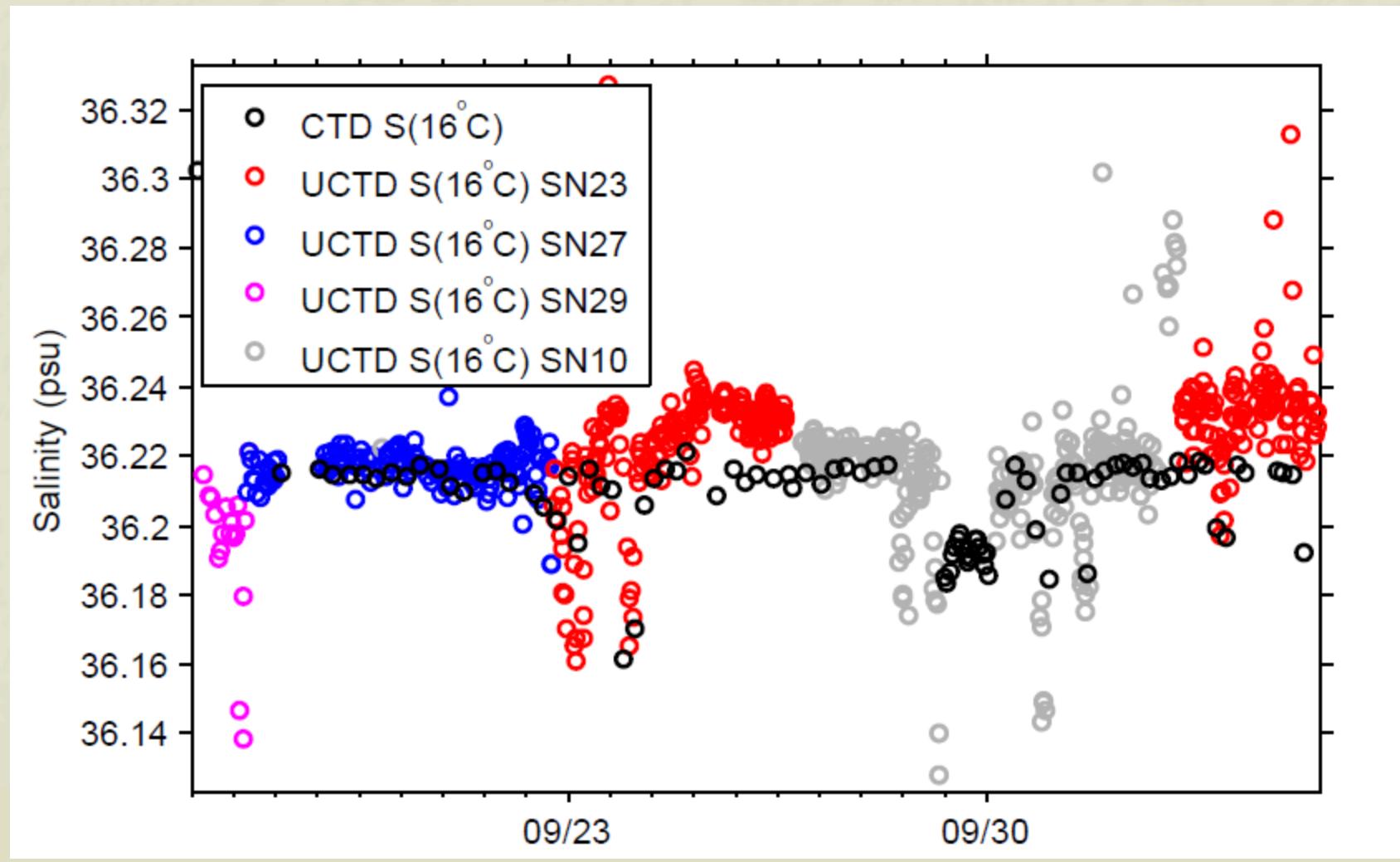
## Final remarks:

(1) Some things to be aware of in using the near-real-time buoy data:
   (1) Only one record is being telemetered, though all parameters are measured by 2-4 independent instruments
   (2) Met/flux estimates will generally be better after recovery, when 1-min records from all instruments will be available (better QC)
   (3) I have doubts about the one telemetered precip record– it is likely an underestimate because of an oversight in the telemetry firmware

(2) We have seen one preliminary evaluation of the upper-ocean heat and salt budgets. I imagine we'll see more in this meeting, and I wonder how many different outcomes/interpretations we will see!